Remarks

Claims 29 to 54 are pending. Claims 1-28, 30, 31 and 33 have been canceled. Claims 37 and 43 - 53 have been withdrawn from consideration. Claims 29 and 54 have been amended, and claims 55-57 have been added. Entry of the above amendments and reconsideration of the application are respectfully requested.

Claims 29-31, 33, 36, and 54 stand rejected under 35 USC § 102(b) as being anticipated by or, in the alternative, under 35 USC 103(a) as obvious over WO 99/65595 to Insley. This rejection has been avoided by the amendment to claim 29, and, to the extent that the rejected claims have not been amended, it is traversed.

In discussing Insley, reference will be made to U.S. patent 6,514,412 which is a the priority document for WO 99/65595 for convenience, since the U.S. patent is also a reference in the office action. Insley is a description of a fluid transport separation device having separation medium 62 and layer 57 with channels 59 next to separation medium 62. Medium 62 removes constituents from a fluid mixture as fluid passes through medium 62.

There are substantial differences between Insley and the rejected claims, as amended. Insley's channels 59 are not for gas delivery. Insley teaches against having gas in them. At column 8, lines 23-31, he states that there is single phase liquid flow, i.e., without entrained gas in the liquid. His article is described as a filter for liquids at col. 9, ll. 23-41, col. 10, ll. 20-29 and 66, col. 11, ll. 10 and 20, and the example at col. 13, ll. 43-60. Therefore, Insley's layer 57 is not a gas delivery layer.

Further to the same point, the flow in Insley's device is described as being from outside the separation medium 55 (or 154) through the separation medium and into the flow channels from which the filtered fluid is conducted elsewhere (see col. 9, ll. 35-44, col. 10, l. 62- col. 11, l. 20). The inventive layered sheet construction is designed for use in membranes used in waste water treatment, specifically membranes on which a microbial population, microbial layer or biofilm is formed on the outside (the gas permeable, water impermeable layer). A gas flows through the gas delivery layer to the surface of the gas permeable, water impermeable layer to assist in the growth of bacteria. This is the opposite of the flow of fluid in Insley.

The Examiner's assertion of inherency is traversed (office action p. 3). Although Insley discloses using his separation media for gas-liquid, gas-solid, liquid-solid or liquid-liquid separations, the only flow direction he discloses is as described above, in which case, the channels could not be used for gas delivery. Insley never teaches delivering gas via layer 57.

In addition, the limitations of cancelled claims 30 and 31 have been incorporated into amended claim 29, so that it now requires that the gas permeable, water impermeable layer comprise a microporous layer coated with a gas permeable, polymeric coating. No such coating is disclosed in Insley.

As to claim 36, Insley is also missing any disclosure of a microbial population on a gas permeable, water impermeable layer.

As to claim 54, Insley lacks a microbial support layer on the gas permeable, water impermeable layer comprising a material suitable for the attachment and growth of microbes and which is hydrophilic. Insley discloses additional layers 72 and 74 on his separation media 62, but they are characterized as additional separation layers (col. 6, ll. 4-7). Nowhere does he teach making them hydrophilic.

Because of the differences recited above, Insley does not anticipate the rejected claims, as amended. In addition, they are not obvious from the disclosure of Insley. In order to arrive at the rejected claims, one would have to modify the teaching of Insley by: i) reversing the flow through the separation device; ii) conveying gas through channels 59 and out through separation media 62 despite his teaching to avoid even gas entrained in liquid in the channels; iii) adding a gas permeable polymeric coating on a microporous separation layer despite the absence of any teaching on such coatings in Insley; and iv) (as to claim 54) adding a microbial support layer that is hydrophilic despite the absence of any teaching to do so in Insley. These modifications to Insley are too great to be obvious to one of ordinary skill. There is no reason found in the reference or the general knowledge of the art to make them.

Claims 32 and 35 stand rejected under 35 USC § 103(a) as being unpatentable over WO 99/65595 to Insley as applied to claim 29, in view of Cote et al. (6,558,549). This rejection is traversed.

At the top of office action page 4, the Examiner has admitted that Insley does not teach a gas delivery layer interposed between two gas permeable layers. In addition, Insley does not disclose the requirement of claim 32 that the gas delivery layer have two sides having a plurality of walls forming flow channels through which gas can be conveyed. Although Cote has spacer 14 between membranes 12, his spacer is not described as having two sides having a plurality of walls forming flow channels through which gas can be conveyed. Instead, Cote's spacer is described as polypropylene expandable diamond mesh (col. 6, ll. 30-32).

Therefore, in addition to the differences recited above, Insley lacks the two-sided gas delivery layer feature of claim 32. In order to arrive at claims 32 and 35 from the teaching of Insley, one would have to make all the modifications described above and, in addition as to claim 32 replace Insley's diamond mesh spacer with a gas delivery layer having walls forming flow channels on both sides. No motivation to make such a modification arises from the cited art.

Claim 34 stands rejected under 35 USC § 103(a) as being unpatentable over WO 99/65595 to Insley as applied to claim 29, in view of Rinker et al. (4,333,779). This rejection is traversed.

Rinker does not teach using corrugation for porous membranes (i.e., gas permeable, water impermeable). He only mentions plastic materials listed at columns 2-3 as sheets, and nowhere discloses porous membranes. Rinker uses corrugated sheets (not porous membranes) for an improved packed tower or trickling filter (col. 1, ll. 12-26). The combination of Rinker with Insley also leaves the deficiencies recited above with regard to the first stated rejection. The Examiner's explanation of the obviousness of combining Rinker with Insley (Office Action p.5) is not reasonable. Although "fall through" of wastewater is an issue in tricking filters or packed towers (the purpose of Rinker) it is not an issue with membrane bioreactors (the purpose of the present invention) or separation devices like filters (as taught in Insley). There is no reason arising from the cited references for a person skilled in the art to adopt Rinker's improvement for trickling filters in membranes for bioreactors.

Claims 38, 39, and 42 stand rejected under 35 USC § 103(a) as being unpatentable over WO 99/65595 to Insley in view of Mrozinski et al. (5,989,698). This rejection is traversed.

As noted above, Insley lacks disclosure of a gas delivery layer proximate the gas permeable, water impermeable layer of part a, since Insley does not teach delivering gas via the passages 59 in his layer 57. Therefore, contrary to the Examiner's statement at Office Action page 5, Insley does not teach each and every element of the claimed sheet construction except the coating of a fluorochemical on the surface of the gas permeable, water impermeable membrane.

Mrozinski is the only cited reference that discloses a porous membrane having improved oleophobicity by virtue of a fluorocarbon urethane coating. Mrozinski's coated porous materials are taught for such applications as transdermal drug delivery substrates, agricultural and medical apparel and protective garments (col. 1, ll. 39-45).

Although the Mrozinski type membranes are one means for meeting part i of claim 38, there is no suggestion in the art itself that such a membrane should be utilized in the separation device of Insley. The Examiner has said that one would be motivated by a desire to provide improved oleophobicity. That was the motivation of the present inventors, but that motivation is not found in the references or the prior art. It is part of the teaching of the present application that wet out of bioreactor membranes by oil or grease is to be avoided, see specification pp. 8-9 and 30, and the inventors found that using Mrozinski type membranes as the gas permeable, water impermeable layer of part a is one way to give this useful property to the layer. Neither Insley nor Mrozinski indicates that oleophobicity is sought as a property in the Insley separation devices.

In order to have the layered sheet construction of claim 38 from the disclosures of Insley and Mrozinski, one would have to: change the flow of fluid in Insley from fluid flowing into the face of separation media 62, through the media and into channels 59 to the reverse flow; use the channels 59 as a means for delivering gas through the separation media 62 and to the surface for the growth of bacteria on the surface; and improve the oleophobicity of layer 62 by making it from the Mrozinski microporous films coated with fluorocarbon urethane despite the fact that Mrozinski does not suggest using his invention in wastewater treatment and Insley does not suggest making his separation media oleophobic. These modifications are not suggested by the references nor are they obvious. Hindsight, with the benefit of the knowledge of the present application would be required in order to make such modifications. A *prima facie* case of obviousness for claim 38 and the claims dependent therefrom has not been established.

Claims 40 and 41 stand rejected under 35 USC § 103(a) as being unpatentable over WO 99/65595 to Insley in view of Mrozinski et al. (5,989,698), as evidenced by McDermott et al. (6,068,771). This rejection is traversed.

Although McDermott teaches a fabric material as a permeate carrier 16, it is within a structure of a wound filtration module for ultrafiltration, which is not the same as the inventive layered sheet in which one of the layers is a gas delivery layer b providing a means through which gas can be delivered to a gas permeable, water impermeable layer a. In McDermott, a fluid to be filtered is introduced at one end face of the module 10 and travels through various windings of the module eventually reaching permeate tube 12 (col. 5, ll. 37-49). If a gas stream is being filtered, gas can travel the path described in McDermott, but that does not suggest taking the felt permeate carrier material from McDermott and substituting it for Insley's layer 57 comprising a flexible, semi-rigid or rigid material with a structured surface (col. 5, ll. 2-14). In McDermott, the fluid to be filtered is moving through the permeate carrier 16 toward the center of the cylindrical module; while, in Insley, fluid being filtered moves from the outside of the separation media 62, through that layer and into the channels 59. There is nothing in the cited references suggesting that one should apply McDermott's felt material as a substitute for Insley's layer 57. Even if one made the substitution of materials from McDermott into Insley, all the reasons given above contrary to the obviousness of claim 38 would apply.

Claims 38-42 stand rejected under 35 USC § 103(a) as being unpatentable over Cote et al. (6,558,549) in view of Mrozinski et al. (5,989,698). This rejection is traversed.

As discussed above with regard to the combination of Insley with Mrozinski, it was the present inventors who recognized the desirability of improved oleophobicity in gas permeable, water impermeable layers for use in membrane bioreactors (specification pp. 8-9 and 30) to avoid wet out of the membrane by oils and greases in wastewater. It was they who created the solutions to this problem specified in claim 38. Although Mrozinski teaches ways to make microporous membranes more oleophobic, he did it for purposes unrelated to waste water treatment, e.g., protective garments. For a *prima facie* case of obviousness, the incentive to combine Mrozinski with Cote as the Examiner has done must be present in the prior art itself. It can not come from a hindsight reconstruction of the rejected claims using bits and pieces of prior patents.

Claim 42 is even more distinct from the combination of Cote with Mrozinski. Neither Cote nor Mrozinski disclose a gas delivery layer comprising a base having a side on which there are a plurality of walls forming flow channels through which gas can be conveyed to the layer of part a. Nothing in either reference would lead one skilled in the art to make a layered construction having such a gas delivery layer.

New claim 55 depends from claim 54 and adds the features (i) – v)) to render the microbial support layer hydrophilic. These features are described in the specification at pages 15-16. Feature i) is found in U.S. Patent Application Serial No. 10/023267 incorporated by reference at specification p. 15 (now published as Pub. No. US 2003/0138619 A1 July 23, 2004). It is desirable to have a hydrophilic microbial support layer, and such a layer having features i) – v) is not found in the cited references.

New claim 56 incorporates into the claimed layered sheet construction a microbial support layer loaded with a filler selected from a Markush group (e.g., peat, coke, activated carbon). These fillers are found in the specification page 16, and they can improve the water absorbing capacity of the microbial support layer among other things.

New claim 57 incorporates a microbial support layer characterized by carrying a net positive surface charge. Basis for this claim feature can be found at specification page 17. Bacteria can have a net negative surface charge, and a positive surface charge on the microbial support layer can help retain the microbial population and reduce the time required to establish a microbial population. Claims 55-57 add features which are neither found in nor obvious from the cited references.

The non-obviousness of the present claims is further supported by the benefits which they bring to the field of water treatment:

- The layered sheets having a gas delivery layer with walls can be punctured in one location without disabling a whole water treatment apparatus. Since there are a plurality of gas flow channels in the inventive layered construction, only part of the membrane would be flooded as a result of a single puncture, see specification p. 4 and p. 12, l. 31-p. 13-l. 11.
- For those embodiments having a microbial support layer, a support layer reduces sloughing off of the microbes, see specification p. 17, ll. 20-32, and Example 7.

Claims 29-31, 33, 36 and 54 have been rejected under the doctrine of obviousness type double patenting in view of U.S. Patent 6,514,412. This rejection has been avoided by the claim amendments. As discussed above, the amended claims are patentably distinct from Insley 6,514,412.

In view of the above discussion, it is respectfully submitted that claims 29, 32, 34-42 and 54-57, as amended, are in condition for allowance. Withdrawal of the rejections under 35 U.S.C. 102 and 103 and the doctrine of obviousness type double patenting are requested and a notification of allowability is respectfully solicited. If any issues or questions remain the resolution of which the Examiner feels would be advanced by a conference with Applicants' attorney, she is invited to contact such attorney at the telephone number noted below.

Respectfully submitted,

January 21, 2004
Date

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OMB No. 0651-0011

INFORMATION DISCLOSURE STATEMENT	Atty. Docket No.: 56754US002	Serial No.: 10/017,632
	Applicant(s): Jonathan Hester, Brian E. Spiewak, David R. Holm, Jerald W. Hall, Jr., Seth M. Kirk, Moses M. David, and Brinda Lakshmi	
	Filing Date: December 14, 2001	Group:

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	SubClass	Filing Date If Appropriate
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		3,586,220	06/22/1971	Reinsberg			
		3,971,373	07/27/1976	Braun			
		4,181,604	01/01/1980	Onishi et al.			
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		Document Number	Date of Publication	Country	Class	SubClass	Translation Yes	Translation No

OTHER DOCUMENTS (Including Authors, Title, Date, Pertinent Papers, etc.)

EXAMINER	Date Considered

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FOREIGN PATENT DOCUMENTS

		Document Number	Date of Publication	Country	Class	SubClass	Translation Yes	Translation No
		WO 99/65542	12/23/1999	PCT				
		WO 99/65595	12/23/1999	PCT				
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EXAMINER	Date Considered

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	Applicant(s): Jonathan Hester, Brian E. Spiewak, David R. Holm, Jerald W. Hall, Jr., Seth M. Kirk, Moses M. David, and Brinda Lakshmi	
	Filing Date: December 14, 2001	**Group:**

U.S. APPLICATIONS **DO NOT PUBLISH**

Examiner Initial	
	Serial No. 09/519,449, Diamond-Like Glass Thin Films.
	Serial No. 09/758,764, Self-Mating Reclosable Mechanical Fastener and Binding Strap.
	Serial No. 09/385,265, Capillary Collapse Resistant Microporous Material and Method.
	Serial No. 10/023,267, Plasma Treatment of Porous Materials.

EXAMINER	Date Considered

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